REMARKS

In the final Office Action mailed on June 6, 2006, the Examiner rejected all pending claims (Claims 1-12, 14-22, 38-41, 43-56, 105 and 106). In the present Amendment and Response to Office Action, Applicants have amended Claims 1 and 38. Applicants respectfully request entry of the amendments and full consideration of the remarks contained herein.

Amendments to the Claims

Applicants have amended the claims to further clarify the subject matter that Applicants regard as the invention. For example, independent Claim 1 has been amended to recite "performing a plurality of deposition cycles" in the body of the claim rather than the preamble. In addition, Claim 1 has been amended to recite that "the silicon layer is about 3-25 Å thick" and "forming a silicon-containing compound layer by exposing the about 3-25 Å thick silicon layer to a reactive species, wherein the silicon-containing compound layer has a thickness non-uniformity of about 10% or less." Support for the amended language can be found in the Application, *e.g.*, pp. 22-28 and 31 and Figures 3-7, as originally filed.

Applicants have also amended independent Claim 38 to recite "performing multiple chemical vapor deposition cycles in a reaction chamber" in the body of the claim. Claim 38 has also been amended to recite that "depositing the silicon layer is performed under mass transport limited deposition conditions." Support for the amended language can be found in the Application, *e.g.*, p. 21-28 and Figures 3-7, as originally filed.

Accordingly, Applicants respectfully submit that the amendments to the claims add no new matter and are fully supported by the application as originally filed.

Rejections Under 35 U.S.C. § 103(a)

The Examiner has rejected all pending claims, Claims 1-12, 14-22, 38-41, 43-56, 105 and 106, as being obvious over U.S. Patent Application Publication No. 2003/0059535 (Luo *et al.*) in view of U.S. Patent No. 6,252,295 (Cote *et al.*), so-called "Admitted Prior Art" or U.S. Patent No. 6,503,846 (Niimi *et al.*). Luo *et al.* is asserted for teaching the general features of independent Claims 1 and 38. The Examiner noted that Luo *et al.* does not teach trisilane as a silicon source. Cote *et al.* is asserted to satisfy this deficiency. The Examiner has asserted that

U.S. Patent No. 4,363,828 (Brodsky *et al.*) provides a motivation to combine the trisilane disclosed by Cote *et al.* with the process of Luo *et al.* because Brodsky *et al.* found that trisilane has a faster deposition rate in its deposition process.

In addition, "Admitted Prior Art" and Niimi *et al.* are asserted to disclose features of various dependent claims. Features of various other dependent claims are asserted by the Examiner as being obvious as a matter of routine experimentation.

Applicants respectfully submit that the claims, as amended herewith, distinguish the art of record.

Regarding independent Claim 1, Applicants note initially that this claim has been amended to recite that "the silicon layer is about 3-25 Å thick" and that "the silicon-containing compound layer has a thickness non-uniformity of about 10% or less." In rejecting dependent claims which recite characteristics of the deposited layers, the Examiner has asserted that forming layers with these characteristics is obvious as a matter of routine experimentation. Applicants note, however, that a "particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." M.P.E.P. § 2144.05. In the present case, none of the art of record teaches or suggests how to achieve such advantageously uniform layers using trisilane, let alone recognize the parameters as important for forming such uniform layers using trisilane.

Moreover, Applicants note that processing with trisilane in place of silane or disilane would not be considered "routine" by the skilled artisan, as the Examiner appears to suggest, nor would the skilled artisan understand teachings regarding silane and disilane to be simply transferable to trisilane. The skilled artisan will recognize that trisilane is a liquid under standard conditions, unlike the most common silicon precursor (silane) and disilane. Moreover, trisilane has a different boiling point, vapor pressure, reactivity, flammability, etc. from other precursors, such as silane and disilane. As a result, reactant supply systems and reactor piping systems for trisilane are different from those of silane and disilane; for example, significant alterations of a reactor system are needed to vaporize trisilane and to maintain the trisilane in the vapor phase. As a result, rather than simply substituting gas sources, as the Examiner appears to suggest, processing with trisilane rather than silane or disilane entails a complete reconfiguration of a

processing system, even before beginning the additional work of developing deposition methods which utilize these systems and which are compatible with trisilane. As a result, Applicants submit that the skilled artisan would not understand the replacement of other silicon precursors, such as silane or disilane, with trisilane to be routine, especially as the use of trisilane requires the development to entirely different systems and methods of using these systems.

Applicants submit that it is Applicants that have advantageously developed systems and methods that advantageously form exceptionally high quality layers of silicon-containing compounds in a cyclic process utilizing trisilane. Applicants submit that none of the art of record teach or suggest systems or methods for forming such high quality layers.

Consequently, Applicants respectfully submit that Luo *et al.*, Cote *et al.*, and Brodsky *et al.* do not render obvious Claim 1, nor its dependents. Applicants also respectfully submit that the other art of record does not satisfy the deficiencies of Luo *et al.*, Cote *et al.*, or Brodsky *et al.*

Regarding independent Claim 38, Applicants note that this claim has been amended to recite that "depositing the silicon layer is performed under mass transport limited deposition conditions." The skilled artisan will understand that, under such conditions, process parameters are chosen such that "deposition rates are essentially independent of temperature." *See, e.g.,* the Application p. 21. Processing under such conditions can advantageously facilitate the formation of the thin and advantageous layers of the present claims. Applicants submit that the art of record does not teach or suggest processing under such conditions. As a result, Applicants respectfully submit that Claim 38 and its dependents are not obvious over Luo *et al.*, Cote *et al.*, and Brodsky *et al.*, nor the other art of record.

While Applicants have amended the claims to expedite prosecution of the present Application, Applicants note for completeness that Applicants do not acquiesce in the Examiner's assertions. For example, Applicants submit that the asserted motivation to combine, to increase the deposition rate, does not provide the requisite motivation in the cyclic process of the claims. "The prior art must suggest the desirability of the claimed invention." M.P.E.P. § 2143.01. The skilled artisan will understand that mechanical switching of gas flows and the time required for any purging are throughput-limiting factors in a cyclic deposition process, such that deposition rates are less significant for a ***cyclic*** process than for a ***bulk*** deposition, such as disclosed by Brodsky *et al.* (in which the entire thickness of a hydrogenated amorphous silicon

layer is deposited in a single deposition step). Applicants note that Brodsky *et al.* does not teach that the advantage asserted by the Examiner extends generally beyond the bulk deposition of hydrogenated amorphous silicon layers. Applicants also note that the differences between cyclic depositions and bulk depositions are especially pronounced where the layers formed in each cycle are exceptional thin, as in the present claims. In such cyclic depositions, the amount of silicon deposited per cycle is low, while the number of cycles needed to build a final layer of a given thickness is high. As such, any increase in deposition rate would have a minimal effect on throughput, and would not be recognized by the skilled artisan as providing a motivation to undergo the time and expense and development effort to overcome the technical difficulties involved in reconfiguring a reactor system to utilize trisilane. Consequently, Applicants respectfully submit that Luo *et al.*, Cote *et al.*, and Brodsky *et al.* do not establish a *prima facie* case of obviousness.

Accordingly, Applicants respectfully submit that the pending claims are allowable over the art of record. Furthermore, any remarks in support of patentability of one claim should not be imputed to any other claim, and any remarks based on a portion of a claim should not be taken as founding patentability on that portion. Rather, it is intended that patentability rests on the claim as a whole. Furthermore, any such remarks which do not quote the claim portion verbatim should not be used to vary the meaning of the claim, as such are intended as a convenience to improve readability. If not specifically addressed herein, Applicants respectfully traverses each of the Examiner's rejections and assertions as to what the prior art shows or teaches, alone or in combination. Although amendments have been made, no acquiescence or estoppel is or should be implied thereby. Rather, the amendments have been made to expedite prosecution and are without prejudice to assertion of such subject matter in future applications.

CONCLUSIONS

In view of the foregoing, Applicant submits that the application is in condition for allowance and respectfully request the same. If any issue remains which the Examiner feels may

be addressed by Examiner's amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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By: _____

Zi Y. Wong
Registration No. 58,410
Attorney of Record
Customer No. 20,995
(415) 954-4114

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